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ABSTRACT

The project that this report evaluates was designed to increase elementary and junior high student achievement levels, competency, and motivation for achievement in reading and mathematics through a competency-based mathematics and reading curriculum based upon utilization of a diagnostic-prescriptive instructional method. This report describes the instructional method, the schools, students, and teachers serviced, the project objectives, and the evaluation objectives. The study concludes that the effectiveness of the project cannot be adequately evaluated until it is fully implemented. (MP)

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EVALUATION OF TEACHING AND LEARNING MODELS

FOR

MATHEMATICS AND READING

FINAL REPORT

AUGUST 1978

Coordinated under the direction of
The Division of Research & Evaluation
D.C. Public Schools

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CHAPTER I

THE SCOPE OF THE PROJECT

Introduction

The Teaching and Learning Models for Mathematics and Reading Program seeks to increase elementary and junior high student achievement levels, competency, and motivation for achievement in reading and mathematics through an innovative competency-based mathematics and reading curriculum based upon the effective utilization of a diagnostic-prescriptive method for improving student performance in areas of demonstrated deficiency. Over 1400 sixth through ninth grade students from seven participating schools located in Region II of the District of Columbia were expected to be involved in the project during its initial year of operation.

The Teaching and Learning Models Project was designed to increase student competencies in analytical, consumer-producer, communication, and self-actualization skill areas. Specific goals were established for both the reading and mathematics components of the program. By the end of the school year, 75% of participating students were to be able to: identify new words through application of phonetics, spelling patterns, and word parts; spell words correctly; listen with attention; skim for information; find the main idea in stories, paragraphs, and sentences; read and write numerals up to and including billions; express standard numerals in expanded form; perform fundamental operations on whole numbers and fractions; solve problems; classify, identify, and illustrate lines, angles, and polygons; calculate perimeters and areas of simple plane figures; and interpret pictographs, bar graphs, line graphs, and circle graphs.

Project goals for student improvement in reading and mathematics achievement levels, competency and motivation were accomplished through the implementation of sequenced instructional objectives for grades one through eight. Criterion-referenced tests were established for each objective.

Sequenced instructional activities, as well as innovative teaching materials, were designed and validated during a teacher workshop. A further aim of the project involved introducing parents and volunteers to the diagnostic methods used to identify student skill levels.

The Diagnostic-Prescriptive Method

The Diagnostic-Prescriptive Method employed by the Teaching and Learning Models for Mathematics and Reading Program uses a series of check-in tests to locate student weaknesses in those instructional objectives established for the program. Prescriptive activities are established for those objectives the student has not mastered as indicated by test performance. Curriculum materials such as workbooks, kits, games, cassettes, duplicating masters, series, and manipulatives are used by the student in prescriptive activities designed to meet a specific learning objective. Prescribed activities, however, are not based solely upon diagnostic skill levels, but also take into account the individual stages of intellectual development (concrete, semi-concrete and abstract) and levels of learning (verbal association, discrimination, concept formation, rule learning, and problem solving.)

The effective utilization of the diagnostic-prescriptive method to improve student performance requires that objectives are stated in measurable terms and that adequate progress assessment is provided for each student. Each student is provided with a progress plotter upon which he records the accuracy of his work in completing a given prescription. A performance of 80% accuracy is considered the criterion for successful completion of that prescription.

Once a student has completed all the assigned prescriptions for a certain instructional objective, he takes a check-out test to diagnose whether or not he has successfully mastered that instructional objective (80% accuracy is again the criterion used). If the student has mastered that objective, then he will go on to the next learning objective, repeating the check-in/check-out cycle. However, when the student demonstrates an inadequate mastery of an objective on the check-out test, then remediation by a parent or undergraduate tutor is required, with the addition of new prescriptions for completion to encourage the student to a higher level of mastery of the given objective. In order to encourage students, reward and reinforcement is continually built into the learning process.

Student deficiencies are intially diagnosed through the administration of the McGraw-Hill Screening Test in Whole Numbers and the Spache Diagnostic Scale. Continuing diagnosis, on a weekly and semester basis, is facilitated through the use of teacher-made tests.

The project's regimen of diagnostic-prescriptive instruction is conducted in a regular classroom setting in order to provide students with a sense of continuity in the instructional program.

Schools, Students, and Teachers Serviced

During its initial year of operation, the Teaching and Learning Models for Mathematics and Reading Project was conducted at six schools located in Region II of the D.C. Public School System. The schools originally proposed for participation were: Amidon, Bowen, Deal, Jefferson, Randall, Sacred Heart, and Syphax. Of these schools, Amidon, Bowen and Jefferson -- located in the Southwest Corridor of Region II -- had consistently high percentages of third through eighth grade students scoring below average national stanines in mathematics and reading, as indicated by a May 1976 administration of the Stanford Achievement Test. The performance of some sixth-grade students participating in a competency-based reading and mathematics performance proved an exception, however, and suggested a course for improvement.

An October 1976 SRA testing of 6, 7 and 8 grade Sacred Heart students indicated that from 38% to 59% of these students were performing one year or more below their grade in mathematics and reading levels. These data provided a further demonstration that students from that school required the support of a competency-based curriculum in reading and mathematics. However, Sacred Heart received Teaching and Learning Models materials too late in the school year to allow participation in this year's program.

The Teaching and Learning Models for Mathematics and Reading Project was under the direction of nineteen elementary and junior high school teachers, who recruited assistants from a population of parents and undergraduate teachers.

Over 1400 students were scheduled to participate in the program during its first year. However, the actual number of student participants fell far short of this projection.

Project Objectives

As stated in the project proposal, the major objectives for the Teaching and Learning Models for Mathematics and Reading are:

"A. Given a competency-based mathematics and reading curriculum, detailed classroom management procedures, sequenced instructional activities which reflect the levels of learning and stages of intellectual development, parent-aides, and tutors, seventy-five percent of the participating students in grades 6, 7, 8 and 9 at Amidon, Bowen, Deal, Jefferson, Randall, Sacred Heart, and Syphax will, during the 1977-78 school year --

1. Increase their achievement level in mathematics (concepts, computation, and application) and reading (vocabulary, word study skills and comprehension) by one year or more, as measured by the Stanford Achievement Test, Intermediate Level I and Level II.

2. Increase their competency in mathematics (computation, solving problems, number and numeration, and geometry and measurement) and in reading (phonetics, spelling, decoding, comprehension) by six or more skills as measured by the Prescriptive Mathematics Tests and the Prescriptive Reading Tests.

3. Develop a more positive attitude toward mathematics and reading, as measured by Osgood's Semantic Differential.

B. Given a corps of volunteer parent-aides trained to conduct parent workshops on testing and assessing their childrens' needs in mathematics and reading, fifty percent of the parents of students participating in the program will --

Increase their support of, involvement in, and understanding of the Prescriptive Mathematics Test, Prescriptive Reading Test and the Stanford Achievement Test as measured by the percentage of students present on the days that the above named tests are administered, and by the number of participants in the parent workshops.

C. Given the participation in a two-week summer training workshop, continuous on-the-job supervision in the teaching of mathematics and reading skills/concepts, a format for writing learning activities and objectives from the D.C. Public Schools Reading and Mathematics Skills Checklist, which are keyed to criterion items on the PMT, PRT, and Stanford Achievement Tests, the teachers will --

1. Design and validate, in the classroom, a minimum of five sequenced instructional activities, which can be used to teach the concept of addition, subtraction, multiplication, and division for each of the following manipulatives: place value sticks, base ten blocks, abacus, math balance, and toy money. Effectiveness of the activities will be determined by student attainment of the specified competencies.

2. Design and validate, in the classroom, a minimum of five sequenced instructional activities for a minimum of four skills in the area of comprehension. Effectiveness of the activities will be determined by student attainment of specified competencies."

Evaluation Objectives

A formative and sumative evaluation was proposed to assess the overall effectiveness of the project. The formative evaluation was proposed for the assessment of the project in relation to the plan of work, project goals, and short term objectives, with emphasis placed on the feedback of information to the project staff in order to assist them in their decision-making for day-to-day program activities. The overall purpose of the formative evaluation was to assist the project staff in achieving their projected objectives.

The sumative evaluation was designed to measure the level at which the project objectives were achieved. More specifically, the sumative evaluation objectives were:

1. to determine the extent to which the project has helped the students to increase their achievement level in Mathematics, as measured by the Stanford Achievement Test, Intermediate Level I & II;
2. to measure the degree to which the project might have helped to increase the competence of students in mathematics and in reading by six or more skills as measured by PMT and PRT.
3. to discover how much of a positive attitude students might have developed toward mathematics and reading;
4. to determine how far the involvement of parent-aides might have helped the students to understand the testing process better;
5. to identify the strengths and weaknesses of the program; and
6. to make recommendations for the next year.

Those various evaluation techniques and instruments proposed to meet the evaluation objectives are described in the next chapter.

CHAPTER II

METHODS AND PROCEDURES

A process evaluation with partial product assessment was planned as the design for this evaluation. Two groups, pre and posttest with control group, was proposed for the implementation of the design. Such a design was chosen, since it was considered capable of effectively revealing the quality of the project in terms of student success; of assisting in the examination of those methods and techniques used for the implementation of project activities; and of determining, with precision and accuracy, the extent to which successful outcomes should be attributed to the effects of the project.

Instrumentation

On-site observations, interviews, questionnaires, and standardized tests were the primary evaluation instruments proposed for the project evaluation. However, the evaluators were unable to obtain pre and posttest results from the project office for inclusion in this report. Furthermore, it was the opinion of the project director that implementation of the program came too late in the school year to influence student performance to the extent that test scores would provide any meaningful indication of project operations. Therefore, the sumative evaluation was conducted through the use of observations, interviews, and teacher questionnaires.

The evaluators visited five of the six participating schools and interviewed the teachers and most of the principals at these schools. Classes were observed in session, and some schools were visited more than once so that as many project classes as possible might be observed. It should be noted, however, that both the teachers and the evaluators had great difficulty in distinguishing between 2-W Project operations and those of the Teaching and Learning Models for Mathematics and Reading. In fact, the evaluators observed several 2-W classes that were to have been Teaching and Learning Models classes. Although the project director carefully scheduled all school visitations with the teachers, confusion ensued since the project director for both programs was the same person and since very few teachers at participating schools even knew about the Teaching and Learning Models project.

Ten of the 13 project teachers and 3 principals involved in the program were interviewed. The interviews were informal and conducted in a non-threatening fashion, although a brief interview schedule was used. Due to the year-end school-closing ceremonies at most schools, many teachers were away on special assignments and principals were heavily committed to their office work. Nevertheless, those present at the schools were gracious and cooperative with the evaluators.

The teacher questionnaire was designed to measure teacher attitudes to the project and teacher perceptions of the extent of in-service training they had received, parental involvement, and student progress. The questionnaire was comprehensive enough to reveal several interesting aspects of program operations to the evaluators. However, some teachers did not return the questionnaires, even after personal contacts from the project director. The questionnaire results reported herein are, therefore, from a limited number of teachers.

CHAPTER III

FINDINGS OF THE STUDY AND RECOMMENDATIONS

The Teaching and Learning Models for Mathematics and Reading Project operated last year in six of the seven schools originally proposed for inclusion in the program. The Sacred Heart School, the only non-public school of the seven participating schools, was unable to participate in the program due to the late arrival of program materials. Having already begun the school year with their own reading and mathematics materials, the Sacred Heart staff decided that switching to different instructional materials in the closing months of the school year would create too many problems for their students.

The six participating schools were: Amidon, Bowen, Deal, Jefferson, Randall, and Syphax. Over 500 students in grades 6 through 9 and 13 teachers participated in the program during the 1977-78 school year.

NUMBERS OF TEACHERS AND STUDENTS PARTICIPATING IN THE TEACHING AND LEARNING MODELS FOR MATHEMATICS AND READING PROJECT -- BY SCHOOL

School	Number of Teachers	Number of Students
Amidon	2	60
Bowen	2	50
Deal	3	235
Jefferson	3	120
Randall	2	55
Syphax	1	28
Total	13	548

Although some of the schools visited appeared to have an effective program, very few of the other teachers at the school knew about the program. If the program is to grow within the D.C. Public Schools System, it is essential that program activities receive wider notoriety especially among teachers and administrators. It is, therefore, recommended that principals and teachers involved in the program share program methods and materials with other teachers and students involved in reading and mathematics teaching and learning in the same school. It is further recommended that teachers be consulted before materials are ordered.

A major problem in implementing the program involved the late arrival of instructional materials. The project director and teachers pointed to the late arrival of materials as the major cause for the lateness of the project. More careful planning and scheduling during the summer months prior to the opening of the school year might help alleviate this situation. Perhaps the project director could work closely with the D.C. Public Schools' Procurement Office in the ordering of all supplies and materials so that they will be on hand when needed by teachers and students. It is, therefore, recommended that every effort should be made to order instructional materials in sufficient quantity as early as July for use in the classroom from the very beginning of the school year. It is also recommended that reserve supplies be kept on hand for future use.

Teachers, parents, and students reported during interviews that the amount of full-time leadership provided for the program was inadequate for meeting the needs of the project. The present project director is also the full-time director for 2-W projects, a position requiring a considerable amount of effort in staff training, coordination of programs, solving of everyday problems, and other administrative functions.

Consequently, the Teaching and Learning Models for Mathematics and Reading Project did not receive the full attention of the project director. The demands of each project are considerable. It is, therefore, recommended that the Teaching and Learning Models for Mathematics and Reading Project should have a full time project director of its own to perform those various tasks and duties necessary for the successful implementation of project activities on a day-to-day basis.

One of the special features projected for the implementation of the program was the involvement of trained parental assistants in classroom instruction. This component was designed to provide mutual learning benefits to teachers, parents, and children. This component, however, was not expedited during the year, since funds were not available to train or hire parents. It is, therefore, recommended that parental assistants receive appointments from the very beginning of the school year and that they receive a proper orientation for their job so that they will be of assistance to teachers and students, on a familiar basis.

Although all six schools participating in the program had math teachers working with project materials and techniques, only two schools -- Randall and Amidon -- had reading teachers. One of the major objectives of the project was to strengthen both mathematics and reading skills among junior high school students. According to some of those teachers interviewed, the project did not "challenge" the reading teachers as much as the math teachers, for various reasons. For example, 2-W and Title I projects similarly placed a heavy emphasis upon the development of math and reading skills. When they made significant progress in reading improvement and less improvement in mathematics, many of their reading teachers were not convinced of the need for additional reading training or materials. Reading teachers did not have the time or the interest

to use an additional method for enhancing student reading skills, when students were largely perceived as progressing satisfactorily, at least when their reading skills were compared to their mathematics skills. However, both teachers and students who participated briefly in the project last year felt that reading instruction in the classroom was still a problem area. The effectiveness of the reading component of the Teaching and Learning Models Project cannot be determined until it is actually put into use in the classroom, where other methods of reading instruction, though adequate, have not entirely solved the problem of increasing student reading comprehension. It is, therefore, recommended that every effort be made to order, deliver and implement instructional materials for reading as well as mathematics at the very beginning of the school year so that these materials can be used effectively with students throughout the entire year. Furthermore, such materials and resources should be proposed for the continuation of the project into higher grades and for the orientation of new courses at each grade level, once the effectiveness of such materials has been demonstrated in the classroom.

Several parents and teachers complained that the conventional grading system used for students participating in the program is not especially well geared to project operations in the classroom. Students either master or do not master a specific skill expected of them. This mastery cannot be partial if the student is to satisfy the requirement for meeting that skill. On the PMT and PRT students are identified with a percentage of skill mastery, rather than with a specific score or letter grade. It is, therefore, recommended that teachers be permitted to

substitute a pass/fail system for the present letter grade system presently in force in program courses. Furthermore, the grading and recording system should be made uniform among the six participating schools.

Several project teachers complained that they did not understand what was expected of them through the project. They did not receive any sort of special training during the year on the use of instructional materials or resources supplied to them. Teachers were provided with only one summer orientation project, and a great length of time passed between this orientation session and the actual arrival of materials in late spring. Even the school principals were largely lacking in the expertise required to lead teachers in the successful implementation of project techniques. Although the project director attempted to explain the basic concepts and mode of operation, teachers were still unable to put project operations into practice. It is, therefore, recommended that at least two workshops (one for both the fall and spring semesters) in addition to the summer training sessions be conducted each year. In addition, teachers of participating schools should be provided with the opportunity to occasionally meet to discuss their problems and successes in the project. And finally, principals should participate in the workshops and meetings.

Diagnostic tests provide the principal means for determining student skill levels. These tests are administered system-wide both in the fall and spring semesters. Students in this project do not take any special tests intended for the project evaluation alone. Although the feedback from these tests is in very many ways crucial to the success of the project, many teachers did not receive the test results early enough

to be of use to the students. Spring results are not received until the following fall. It is, therefore, recommended that both the pre and posttest results be made available to the teachers, in an interpretable manner, no later than three weeks after the test administration.

In all of the schools observed, teaching areas were spacious and clean. Some were open space with areas of carpeted space for the children and teachers to work in any way they pleased. Other teaching spaces were divided into rooms that were large enough to be used as classrooms. However, some of the schools did not have any additional space for storage, reading, conferences, tutoring, and the like. There was generally not much space in common areas of the school buildings for display tables to be set up for the benefit of other teachers and students in the school not participating in the program. It is, therefore, recommended that the Teaching and Learning Models for Mathematics and Reading Project be provided with additional space at each school for the purpose of display, demonstration and training. Furthermore, audio-visual equipment, etc. should be provided for both teacher and student training.

CHAPTER IV

CONCLUSION

The Teaching and Learning Models for Mathematics and Reading is a very ambitious project. An extremely late start in the year allowed students only to become oriented in the use of materials received during the closing months of the school year. Only a limited number of teachers, from six schools, were involved in the project. However, these teachers were not provided with an adequate amount of training during the year.

Since test results arrive late every year, project teachers should devise their own formative evaluation system.

It is, furthermore, imperative to the coming success of the project that a full-time project director be appointed before the beginning of the next school year.

The Teaching and Learning Models Project holds much promise for the innovative instruction of reading and mathematics skills to junior high school students, but the effectiveness of project materials and techniques cannot be adequately evaluated until those resources have actually been brought into the classroom on a full-time basis.

Appendix A

TEACHING AND LEARNING MODELS

FOR

MATHEMATICS AND READING

TEACHER QUESTIONNAIRE

1. Name of your School _____

2. Grade you teach _____

3. Number of Students in your class _____

4. How long have you been using the diagnostic-prescriptive method? _____

5. Have you received any training to use the method, prior to your using it? ☐ Yes ☐ No

(If yes, explain the type of training you received)

_____

_____

_____

_____

6. Howmany in-service courses have you attended in connection with the diagnostic-prescriptive method? _____

Explain the nature of such in-service training

_____

_____

_____

7. To what extent have you received on-the-job supervision from the project coordinator?

☐ Great extent

☐ Some extent

☐ No extent

8. Explain the nature of the sequenced instructional activities that you might have developed and validated.

_____

_____

_____

_____

_____

9. How many parents are involved in the program at your School, at present? _____

10. Explain the nature of their involvement in the program. (If no involvement, explain why not).

_____

_____

_____

_____

_____

11. What are some of the changes, you might have noticed in your students in Mathematics and Reading since you started using the diagnostic-prescriptive method? (Intellectual, attitudinal, behavioral or any similar noticeable changes).

_____

_____

_____

_____

12. What are some of the problems you might have encountered with the program implementation?

_____

_____

_____

13. Please circle the number which matches your observation in terms of student achievement, competency and attitude towards Mathematics and Reading.

	Increased by				
	1 Year.	9 Mos.	6 Mos.	3 Mos.	No.
13-1. Mathematics Concepts.	5	4	3	2	1
13-2. Mathematics application.	5	4	3	2	1
13-3. Mathematics Computation Skills.	5	4	3	2	1
13-4. Vocabulary.	5	4	3	2	1
13-5. Word study skills.	5	4	3	2	1
13-6. Comprehension.	5	4	3	2	1
13-7. Spelling.	5	4	3	2	1
13-8. Grammar	5	4	3	2	1
13-9. Problem solving ability.	5	4	3	2	1
13-10. Number and Numeration.	5	4	3	2	1
13-11. Geometry & Measurement.	5	4	3	2	1
13-12. Attitude toward Reading.	5	4	3	2	1
13-13. Attitude toward Mathematics.	5	4	3	2	1
13-14. Other (Specify)					
_____	5	4	3	2	1
_____	5	4	3	2	1
_____	5	4	3	2	1
_____	5	4	3	2	1

14. What did you like most about the project?

_____

_____

_____

15. Comments/Suggestions, if any.